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Docket No.: 905-0248P

BOX PATENT APPLICATION

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): Mamoru MIYASHITA

For: LIQUID CRYSTAL DISPLAY DEVICE AND METHOD OF CONTROLLING SAME

Enclosed are:

- ☒ A specification consisting of twenty-one (21) pages
- ☒ Seven (7) sheet(s) formal drawings
- ☒ An assignment of the invention
- ☒ Certified copy of Priority Document(s)
- ☒ Executed Declaration (☒ Original ☐ Photocopy)
- ☐ A statement (☐ original ☐ photocopy) to establish small entity status under 37 C.F.R. § 1.9 and 37 C.F.R. § 1.27
- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement, PTO-1449 and reference(s)
- ☐ Other:

The filing fee has been calculated as shown below:

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| | BASIC FEE | | \$710.00 | \$355.00 |
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| TOTAL CLAIMS | 4- 20 = | 0 | X 18 = \$0.00 | x 9 = \$0.00 |
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- ☒ A check in the amount of \$710.00 to cover the filing fee and recording fee (if applicable) is enclosed.
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Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By

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905-0248P
 Attachments

SPECIFICATION

TITLE OF THE INVENTION

LIQUID CRYSTAL DISPLAY DEVICE AND METHOD OF CONTROLLING

SAME

5

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a liquid crystal display device having a case formed to include a light-admission window for admitting outside light, and to a method of
10 controlling this device.

Description of the Related Art

A digital still camera has a back side provided with a display screen of a liquid crystal display device for displaying a sensed image. The camera angle can be
15 decided while the image of the subject is being displayed on the display screen.

A liquid crystal display device usually is provided with a backlighting device. The backlighting device illuminates the back side of a liquid crystal display
20 panel constituting the liquid crystal display device. A battery can be used as the power source of the digital still camera taking into consideration the need for portability. The backlighting device is driven using the battery as the power source.

25 In response to the demand for reduced power consumption, a digital still camera formed to include a light-admission window for the purpose of allowing admission of outside light has become available. When

the digital still camera is used outdoors, the light-admission window is opened so that outside light admitted from the window will be introduced to the back side of the liquid crystal display panel. Turning off
5 the backlighting device at such time makes it possible to conserve power.

However, just because outside light is allowed to enter from the light-admission window and the admitted light is introduced to the back side of the liquid
10 crystal display panel does not necessarily mean that the image being displayed by the liquid crystal display device will be easy to see.

DISCLOSURE OF THE INVENTION

Accordingly, an object of the present invention is
15 to make it easy to see an image being displayed by a liquid crystal display device.

According to the present invention, the foregoing object is attained by providing a liquid crystal display device having a case internally accommodating a liquid
20 crystal display panel which displays an image represented by an applied image signal, the liquid crystal display panel having a display screen exposed externally of the case, the case being formed to include a freely openable and closable light-admission window
25 for admitting outside light, and a light guiding path being formed for introducing the outside light, which has been admitted by opening the light-admission window, to the underside of the liquid crystal display panel,

the liquid crystal display device comprising: a backlighting device for projecting backlight toward the underside of the liquid crystal display panel; a setting unit for setting whether to admit outside light from the

5 light-admission window or to project backlight from the backlighting device; a signal correction circuit (signal correction means) for subjecting the applied image signal to a correction for outdoor display in response to a setting by the setting unit for admission of the

10 outside light; and a backlight control circuit for turning on the backlighting device in response to a setting by the setting unit for projection of the backlight.

The present invention provides also a method of

15 controlling the above-described device. Specifically, the present invention provides a method of controlling a liquid crystal display device having a case internally accommodating a liquid crystal display panel which displays an image represented by an applied image

20 signal, the liquid crystal display panel having a display screen exposed externally of the case, the case being formed to include a freely openable and closable light-admission window for admitting outside light, a light guiding path being formed for introducing the

25 outside light, which has been admitted by opening the light-admission window, to the underside of the liquid crystal display panel, and a backlight device being provided for projecting backlight toward the underside

of the liquid crystal display panel, the method comprising the steps of: making it possible to set whether to admit outside light from the light-admission window or to project backlight from the backlighting device; subjecting the applied image signal to a correction for outdoor display in response to a setting for admission of the outside light; and turning on the backlighting device in response to a setting for projection of the backlight.

10 In accordance with the present invention, when a setting is made to admit outside light from the light-admission window, the light-admission window is opened to introduce the outside light to the back side of the liquid crystal display panel. An applied image signal
15 (which may be either an analog video signal or digital image data) is corrected to a signal for outdoor display purposes. The corrected image signal is applied to the liquid crystal display device so that the image represented by the image signal is displayed.

20 When a setting is made to project backlight, the light-admission window is closed and the back side of the liquid crystal display panel is illuminated by the backlighting device. Since the back side of the liquid crystal display panel is illuminated by the backlighting
25 device indoors, an easy-to-see image is displayed.

When outside light is allowed to enter from the light-admission window, the image signal is corrected to one for an outdoor display. An image that is easy to

see outdoors is displayed. Examples of corrections are a gamma correction, luminance correction, contour correction, hue correction and color saturation correction. When a setting is made to allow admission
5 of outside light from the light-admission window outdoors, for example, consumption of power can be reduced because the backlighting device is turned off.

The liquid crystal display device may be provided with an output circuit for making a connection to an
10 external display unit that displays the image represented by the applied image signal and that is removably attached to the liquid crystal display device. In such case it is desirable that the output circuit be turned off in response to a setting by the setting unit
15 for admission of outside light.

In a case where outside light is admitted, the camera often is located outdoors. Instances in which the external display unit is connected outdoors are comparatively few. Accordingly, by turning off the
20 output circuit that connects the external display unit, wasteful consumption of power can be prevented.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying
25 drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a digital still camera as seen from the back side thereof;

Fig. 2 is a sectional view taken along line II-II
5 in Fig. 1;

Fig. 3 is a block diagram illustrating the electrical construction of the digital still camera;

Fig. 4 is a block diagram illustrating the electrical construction of an LCD driver;

10 Fig. 5 illustrates the difference between outdoor and indoor correction amounts;

Figs. 6a to 6f illustrate gamma correction curves and levels of image data; and

Fig. 7 is a flowchart illustrating processing
15 executed by the digital still camera.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described in detail.

Fig. 1, which illustrates an embodiment of the
20 present invention, is a perspective view of a digital still camera 1 as seen from the back side thereof.

The digital still camera 1 has a case the back side of which is provided with a liquid crystal display panel 7 substantially at the center thereof. The liquid
25 crystal display panel 7 displays the image of a subject obtained by photography or an image represented by image data that has been recorded on a memory card. As will be described later, the back side of the liquid crystal

display panel 7 is illuminated by light projected from a backlighting device.

An optical viewfinder 6 is formed at the upper left of the liquid crystal display panel 7. The user can
5 decide the camera angle while observing the image of a subject being displayed on the liquid crystal display panel 7 and can also decide the camera angle by viewing the subject through the optical viewfinder 6. Formed at the lower right of the liquid crystal display panel 7 is
10 a mode setting button 5 for setting various modes such as a picture-taking mode and playback mode.

A light-admission switch 4 for the liquid crystal display panel 7 is provided at the upper right of the liquid crystal display panel 7. Turning the light-
15 admission switch 4 off results in the backlighting device being turned on to illuminate the back side of the liquid crystal display panel 7 with light.

The top of the digital still camera 1 is provided with a light-admission cover 8 on the back side thereof
20 (the portion on the back side of the camera is indicated at numeral 10). The light-admission cover 8 is opened by turning on the light-admission switch 4 and is closed by pushing it with a finger when it is open. If the light-admission cover 8 is opened, a light-admission
25 window is exposed. When the light-admission window is exposed, outside light is allowed to enter from the light-admission window and is introduced to the back side of the liquid crystal display panel 7, as will be

described later.

A power switch 3 is provided on the back of the digital still camera 1 on the right side thereof near the top. A shutter-release button 2 is provided on the top of the digital still camera 1 on the right side thereof near the front.

The left side (the near side in Fig. 1) of the digital still camera 1 is formed to include a freely openable and closable card cover 9. When the card cover 9 is opened, a recess for accommodating a memory card appears. A memory card is removably received within the recess.

The right side (the far side in Fig. 1) of the digital still camera 1 is formed to include an output terminal for making a connection to an external television unit.

Fig. 2 is a cross-sectional view taken along line II-II of Fig. 1.

The back side of the liquid crystal display panel 7 is provided with an acrylic plate 12. A reflecting sheet 13 is affixed to the back side of the acrylic plate 12 (the side of the plate opposite the liquid crystal display panel 7). A backlight 14 is disposed below the acrylic plate 12.

Light BL projected from the backlight 14 illuminates the back side of the liquid crystal display panel 7. If the light-admission cover 8 is opened, outside light OL is allowed to enter from a light-

admission window W. The admitted outside light OL passes through the acrylic plate 12 and is introduced to the reflecting sheet 13. The outside light OL is reflected by the reflecting sheet 13 and illuminates the back side of the liquid crystal display panel 7.

The digital still camera 1 includes also a circuit board 15 on which a circuit, described later, has been formed. A light image representing the image of a subject is formed on the photoreceptor surface of an image sensing device, which has been disposed on the circuit board 15, by an imaging lens unit 16, whereby image data representing the image of the subject is obtained.

Fig. 3 is a block diagram illustrating the electrical construction of the digital still camera 1.

The digital still camera 1 according to this embodiment is such that if the light-admission switch 4 is turned off, it is construed that the camera will be used indoors and, hence, the backlight 14 is turned on. The latter illuminates the back side of the liquid crystal display panel 7 in the manner described above. Thus, a bright image is displayed on the liquid crystal display panel 7 even though the camera is used indoors. If the light-admission switch 4 is turned on, use outdoors is construed and the light-admission cover 8 opens. When this occurs, outside light is introduced from the light-admission window and illuminates the back side of the liquid crystal display panel 7. In

addition, the backlight 14 is turned off. Thus, even though the backlight 14 is turned off, a comparatively bright image is displayed on the liquid crystal display panel 7 by utilizing the outside light.

5 If the light-admission switch 4 in the digital still camera 1 according to this embodiment is turned on, image data representing the image of a subject is corrected so as to be suitable for display outdoors. Though there are instances where an image is difficult
10 to see outdoors, a comparatively easy-to-see image is displayed on the liquid crystal display panel 7 by virtue of the correction applied to the image data. This processing will be described later in detail.

 A signal indicating whether the light-admission
15 switch 4 is on or off is applied to an encoder 23, an LCD (Liquid Crystal Display) driver 25 and the backlight 14. Further, turning off the light-admission switch 4 causes the light-admission cover 8 to open.

 If the picture-taking mode is set by the mode
20 setting button 5 (not shown in Fig. 3), the subject is photographed by an image sensing device 21. A video signal representing the image of the subject is output from the image sensing device 21 and enters a signal processing circuit 22.

25 The signal processing circuit 22, which includes an analog/digital conversion circuit, a gamma correction circuit and a circuit for generating luminance data and color difference data, executes prescribed signal

processing. Image data is output from the signal processing circuit 22 and is applied to the encoder 23 and LCD driver 25.

The image data is supplied from the LCD driver 25
5 to the liquid crystal display panel 7, whereby the image of the subject is displayed on the liquid crystal display panel 7.

The image data that has entered the encoder 23 is subjected to prescribed encoding processing so as to be
10 displayable on the television. Image data output from the encoder 23 is applied to a television unit 30 via an output terminal 24. The image of the subject is displayed on the display screen of the television unit 30. The encoder 23 can be controlled so as to be turned
15 on and off. The encoder 23 is turned off when the light-admission switch 4 is turned on. When the light-admission switch 4 is turned on, it is construed that the camera will be used outdoors. The encoder 23 is turned off because it is considered rare for the
20 television unit 30 to be connected to the camera 1 outdoors.

If the shutter-release button 2 (not shown in Fig. 3) is pressed, image data output from the signal processing circuit 22 enters an image recording/playback
25 circuit 26. The latter executes data compression processing and other recording processing. Image data output from the image recording/playback circuit 26 is applied to a memory card 27 on which the image data is

then recorded.

The digital still camera 1 according to this embodiment has a playback function as well.

If the playback mode is set by the mode setting
5 button 5, image data that has been recorded on the
memory card 27 is read out and applied to the image
recording/playback circuit 26. The latter executes
processing for decompressing compressed image data as
well as other playback processing and inputs the
10 processed image data to the signal processing circuit
22.

Image data output from the signal processing
circuit 22 is applied to the LCD driver 25 and encoder
23. A reproduced image is then displayed on the liquid
15 crystal display panel 7 and on the display screen of the
television unit 30 in a manner similar to that when a
subject is photographed.

Fig. 4 is a block diagram illustrating the
electrical construction of the LCD driver 25.

20 R-Y and B-Y color difference data contained in the
image data output from the signal processing circuit 22
is input to a color balance circuit 31, and luminance
data Y contained in the image data is input to a contour
correction circuit 36.

25 The color balance circuit 31 subjects the entered
color difference data to hue correction processing
(processing which corrects the level of the color
difference data) and to a color saturation correction (a

bluish or reddish correction). Color difference data output from the color balance circuit 31 is applied to a matrix circuit 32.

The contour correction circuit 36 applies contour
5 correction processing to the entered luminance data and outputs the processed luminance data. The luminance data output from the contour correction circuit 36 also is input to the matrix circuit 32.

The matrix circuit 32 generates image data of the
10 three primary colors R, G, B from the applied color difference data and luminance data. The generated image data is input to a contrast adjustment circuit 33, which adjusts the contrast of the image data. The image data output from the contrast adjustment circuit 33 enters a
15 gamma correction circuit 34, which implements a gamma correction conforming to the gamma characteristic of the liquid crystal display panel 7. The gamma-corrected image data is input to a brightness correction circuit 35, where the luminance level is adjusted. More
20 specifically, since G (green) data is regarded as being equivalent to the luminance level, the level of the green data would be adjusted. Image data output from the brightness correction circuit 35 is applied to the liquid crystal display panel 7, as mentioned above.

25 Fig. 5 illustrates the manner in which the amount of correction applied to image data is changed between outdoor and indoor use as described earlier.

In this embodiment, the amounts of correction

involved in gamma correction (gamma correction circuit 34), luminance level correction (brightness correction circuit 35), contour correction (contour correction circuit 36), hue correction (color balance circuit 31) and color saturation correction (color balance circuit 31) are changed. The amounts of correction are all set to predetermined standard values for indoor use of the camera. When the camera is used outdoors, on the other hand, the gamma correction, luminance level correction and color saturation correction are all changed so as to increase from the standard values. The contour correction is changed to provide greater emphasis than the standard value, and hue is corrected so as to obtain a more bluish color (the level of the R-Y color difference data increased).

By thus changing amount of correction when the camera is used outdoors, the image displayed on the liquid crystal display panel 7 becomes easy to see even outdoors.

Figs. 6a to 6f illustrate the characteristics of the image data and gamma correction curves.

The characteristic of the image data obtained by the image sensing device 21 has linearity, as indicated by the solid line 51 in Fig. 6a. The gamma characteristic of the television unit is such that $\gamma = 2.2$ holds, and a suitable image cannot be displayed by the television even if the image data obtained by the image sensing device 21 is applied to the television

unit. For this reason, the gamma correction circuit in the signal processing circuit 22 incorporated in the digital still camera 1 applies a gamma correction using a gamma correction curve 52 of $\gamma = 0.45$ (Fig. 6b).

- 5 By applying image data that has been subjected to the gamma correction using the gamma correction curve for which $\gamma = 0.45$ holds to the television unit, image data having linearity is obtained, as indicated by the solid line 51 in Fig. 6c.

- 10 In the digital still camera 1 according to this embodiment, a gamma correction is applied in the LCD driver 25 as well (by the gamma correction circuit 34), as described earlier. In the gamma correction performed by the LCD driver 25, image data (indicated by the
- 15 dashed line 52 in Fig. 6d) that has been gamma-corrected in the signal processing circuit 22 is subjected to a gamma correction as indicated by solid line 53 or 54 in Fig. 6d. The gamma correction is applied in such a manner that the amount of the gamma correction is made
- 20 more for outdoor use than for indoor use, as set forth earlier. Accordingly, image data after application of the gamma correction for use of the camera indoors becomes as indicated by the solid line 53, and image data after application of the gamma correction for use
- 25 of the camera outdoors becomes as indicated by the solid line 54.

Fig. 6e illustrates the gamma characteristic of the liquid crystal display panel 7. By executing a gamma

correction suited to the liquid crystal display panel 7 using the LCD driver 25, image data having a linear characteristic as indicated by the solid line 56 in Fig. 6f is obtained (in case of indoor use) when the image data is applied to the liquid crystal display panel 7. In case of outdoor use, the lower level is emphasized in comparison with indoor use, as indicated by solid line 57. Accordingly, an easy-to-see image is obtained even outdoors.

10 Fig. 7 is a flowchart illustrating processing executed by the digital still camera 1. Though this processing is processing concerning playback, it goes without saying that processing is executed in similar fashion also at the time of photography.

15 A memory card is loaded into the digital still camera 1 and image data is read out of the memory card. The read image data is input to the image recording/playback circuit 26 and is subjected to playback processing, which includes data decompression, 20 as set forth earlier (step 41). The image data is output from the image recording/playback circuit 26 and enters the liquid crystal display panel 7 via the signal processing circuit 22 and LCD driver 25, as described above. The image represented by the image data that has 25 been recorded on the memory card is displayed on the liquid crystal display panel 7.

The light-admission switch 4 is operated by the user (step 42). If the light-admission switch 4 is

turned on (step 43), the amount of correction applied in the LCD driver 25 is set that for outdoor use of the camera, as described earlier (step 44). Further, the light-admission cover 8 opens and the encoder 23 is
5 turned off (step 45). Outside light is admitted by the light-admission cover 8 and illuminates the back side of the liquid crystal display panel 7. Image data, which has been corrected by the set amount, enters the liquid crystal display panel 7. Since the image data displayed
10 on the display screen of the liquid crystal display panel 7 has been corrected for display outdoors, the image is easy to see even when viewed outdoors.

If the light-admission switch 4 is turned off (step 43), an amount of correction suitable for camera use
15 indoors is set (step 46) and the image data is corrected in accordance with the set amount of correction (step 46). Further, the backlight 14 turns on (step 47) and the liquid crystal display panel 7 is illuminated from its back side by the backlight 14 (step 47). As a
20 result, the image displayed on the liquid crystal display panel 7 is easy to see even indoors.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood
25 that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A liquid crystal display device having a case internally accommodating a liquid crystal display panel which displays an image represented by an applied image
5 signal, said liquid crystal display panel having a display screen exposed externally of the case, said case being formed to include a freely openable and closable light-admission window for admitting outside light, and a light guiding path being formed for introducing the
10 outside light, which has been admitted by opening said light-admission window, to the back side of said liquid crystal display panel, said liquid crystal display device comprising:
 - a backlighting device for projecting backlight
15 toward the back side of said liquid crystal display panel;
 - a setting unit for setting whether to admit outside light from said light-admission window or to project
backlight from said backlighting device;
 - 20 a signal correction circuit for subjecting the applied image signal to a correction for outdoor display in response to a setting by said setting unit for admission of the outside light; and
 - a backlight control circuit for turning on said
25 backlighting device in response to a setting by said setting unit for projection of the backlight.
2. The device according to claim 1, wherein said signal correction circuit subjects the applied image signal to

at least one correction from among a gamma correction, luminance correction, contour correction, hue correction and color saturation correction.

3. The device according to claim 1, further comprising:

5 an output circuit for making a connection to an external display unit that displays the image represented by the applied image signal and that is removably attached to the liquid crystal display device; and

10 an output-circuit control unit for turning said output circuit off in response to a setting by said setting unit for admission of outside light.

4. A liquid crystal display device having a case internally accommodating a liquid crystal display panel
15 which displays an image represented by an applied image signal, said liquid crystal display panel having a display screen exposed externally of the case, said case being formed to include a freely openable and closable light-admission window for admitting outside light, a
20 light guiding path being formed for introducing the outside light, which has been admitted by opening said light-admission window, to the underside of said liquid crystal display panel, and a backlight device being provided for projecting backlight toward the underside
25 of said liquid crystal display panel, said method comprising the steps of:

making it possible to set whether to admit outside light from said light-admission window or to project

backlight from said backlighting device;

subjecting the applied image signal to a correction
for outdoor display in response to a setting for
admission of the outside light; and

- 5 turning on said backlighting device in response to
a setting for projection of the backlight.

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ABSTRACT OF THE DISCLOSURE

Image data that has been recorded on a memory card inserted into a digital still camera is read out. When a light-admission switch is turned on, an amount of
5 correction suited outdoor use of the camera is set. A light-admission window opens so that the back side of a liquid crystal display panel is illuminated by outside light allowed to enter from the light-admission window. As a result, an image corrected based upon the amount of
10 correction set for outdoor use of the camera is displayed. This makes it easier to see an image displayed on the liquid crystal display panel even when the camera is used outdoors.

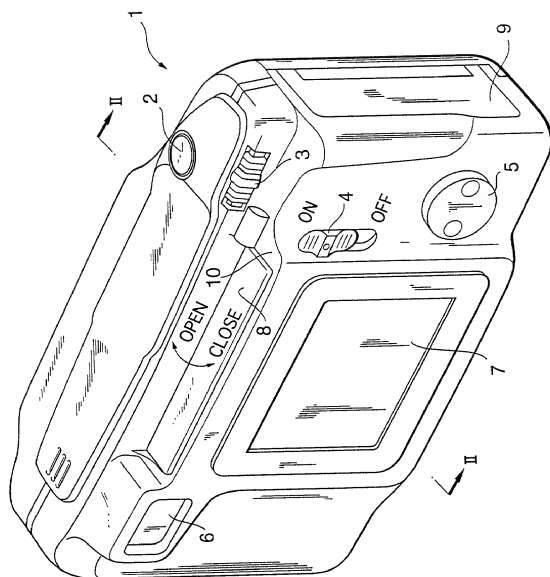
Fig. 1

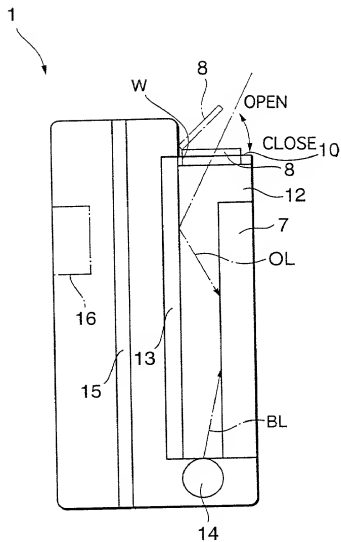
Fig. 2

Fig. 3

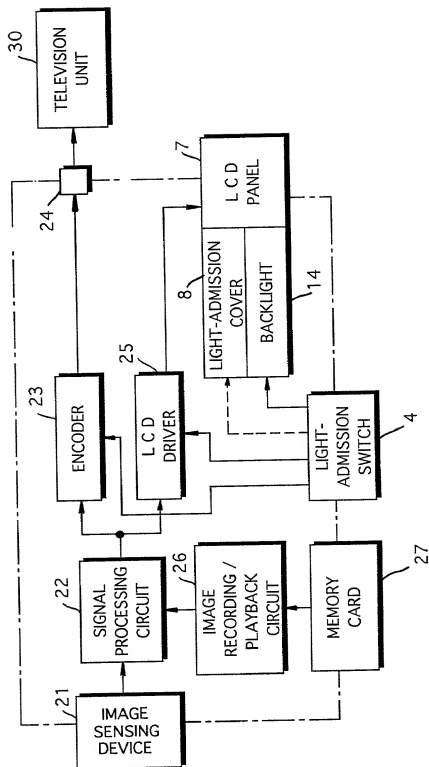


Fig. 4

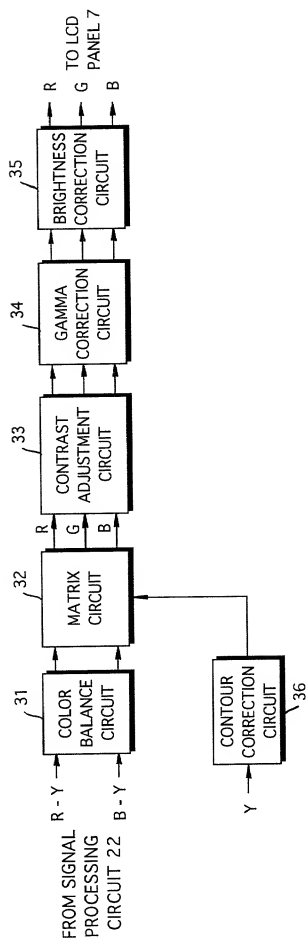


Fig. 5

| | GAMMA CORRECTION | LUMINANCE LEVEL | CONTOUR CORRECTION | HUE | COLOR SATURATION |
|----------|---------------------|--------------------|-----------------------|----------|---------------------|
| OUTDOORS | INCREASE | INCREASE | EMPHASIZE | BLUISH | INCREASE |
| INDOORS | STANDARD | STANDARD | STANDARD | STANDARD | STANDARD |

Fig. 6a

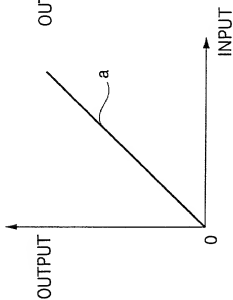


Fig. 6b

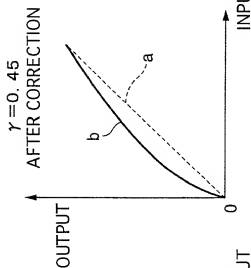


Fig. 6c

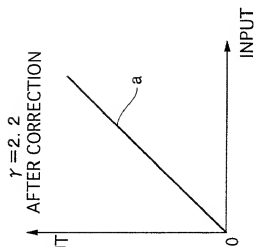


Fig. 6d

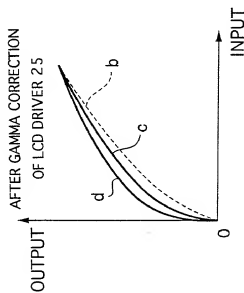


Fig. 6e

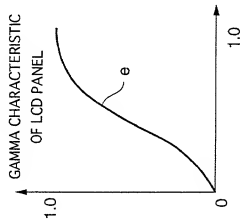


Fig. 6f

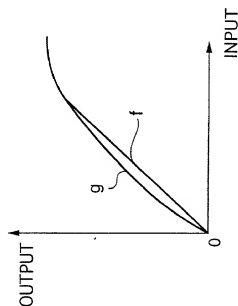
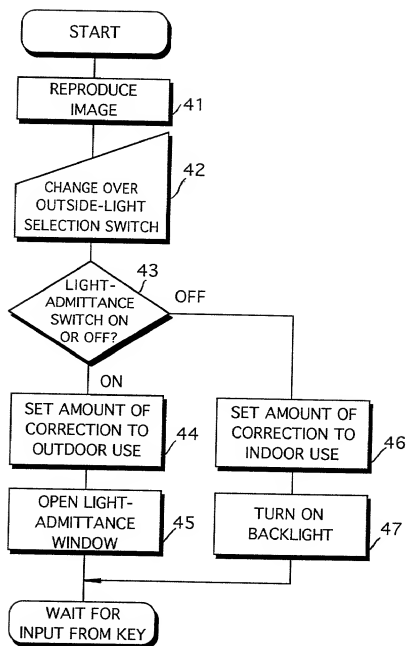


Fig. 7



COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT AND DESIGN APPLICATIONS

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated next to my name; that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Insert Title:

LIQUID CRYSTAL DISPLAY DEVICE AND METHOD OF CONTROLLING SAME

Information -
For Use Without
Specification
Attached:

the specification of which is attached hereto. If not attached hereto,

the specification was filed on _____ as
United States Application Number _____
and amended on _____ (if applicable) and/or
the specification was filed on _____ as PCT
International Application Number _____; and was
amended under PCT Article 19 on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representative or assigns more than twelve months (six months for designs) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

| | | | | |
|-----------------------------|-----------------------------|-----------------------------|---|-----------------------------|
| <u>11-303302</u> | <u>Japan</u> | <u>10/26/1999</u> | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| (Number) | (Country) | (Month/Day/Year Filed) | | |
| <u> </u> | <u> </u> | <u> </u> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (Number) | (Country) | (Month/Day/Year Filed) | | |
| <u> </u> | <u> </u> | <u> </u> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (Number) | (Country) | (Month/Day/Year Filed) | | |
| <u> </u> | <u> </u> | <u> </u> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (Number) | (Country) | (Month/Day/Year Filed) | | |

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional applications(s) listed below.

| | |
|-----------------------------|-----------------------------|
| <u> </u> | <u> </u> |
| (Application Number) | (Filing Date) |
| <u> </u> | <u> </u> |
| (Application Number) | (Filing Date) |

All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More than 12 Months (6 Months for Designs) Prior to the Filing Date of This Application:

| Country | Application Number | Date of Filing (Month/Day/Year) |
|-----------------------------|-----------------------------|---------------------------------|
| <u> </u> | <u> </u> | <u> </u> |
| <u> </u> | <u> </u> | <u> </u> |

I hereby claim the benefit under Title 35, United States Code, §120 of any United States and/or PCT application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States and/or PCT application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| | | |
|-----------------------------|-----------------------------|---|
| <u> </u> | <u> </u> | <u> </u> |
| (Application Number) | (Filing Date) | (Status - patented, pending, abandoned) |
| <u> </u> | <u> </u> | <u> </u> |
| (Application Number) | (Filing Date) | (Status - patented, pending, abandoned) |

I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary:

| | | | |
|---------------------|-------------------|-----------------------|-------------------|
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| Charles Gorenstein | (Reg. No. 29,271) | Gerald M. Murphy, Jr. | (Reg. No. 28,977) |
| Leonard R. Svensson | (Reg. No. 30,330) | Terry L. Clark | (Reg. No. 32,644) |
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| Joe McKinney Muncy | (Reg. No. 32,334) | Donald J. Daley | (Reg. No. 34,313) |
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

PLEASE NOTE:
YOU MUST
COMPLETE
THE
FOLLOWING:

Full Name of First
or Sole Inventor:
Insert Name of
Inventor
Insert Date This
Declaration is Signed

Insert Residence
Insert Citizenship

Insert Post Office
Address

Full Name of Second
Inventor, if any:
see above

Full Name of Third
Inventor, if any:
see above

Full Name of Fourth
Inventor, if any:
see above

Full Name of Fifth
Inventor, if any:
see above

| | | |
|---|---|-------------------------|
| GIVEN NAME/FAMILY NAME Mamoru MIYASHITA | INVENTOR'S SIGNATURE <i>Mamoru Miyashita</i> | DATE* Oct. 10, 2000 |
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| POST OFFICE ADDRESS (Complete Street Address including City, State & Country) | | |
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| Residence (City, State & Country) | | CITIZENSHIP |
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| GIVEN NAME/FAMILY NAME | INVENTOR'S SIGNATURE | DATE* |
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| GIVEN NAME/FAMILY NAME | INVENTOR'S SIGNATURE | DATE* |
| Residence (City, State & Country) | | CITIZENSHIP |
| POST OFFICE ADDRESS (Complete Street Address including City, State & Country) | | |

*DATE OF SIGNATURE